chapter12_2_4 and **chapter12_2_4_extra** Modeling in the Frequency Domain for Example 12.2

We will learn how to use MATLAB’s Symbolic Math Toolbox to solve a system of simultaneous equations which can be represented in matrix form as $AX = B$, where A is the matrix formed for the coefficients of the unknowns, B is a vector containing the input, and X is a vector containing the unknowns.

Tools used

Expression	Description
$\det(A)$	Evaluates the determinant of the square matrix argument
$simple(s)$	Simplifies the solution by shortening the length the symbolic function, *s*

Matrix input: this is simply accomplished by enclosing the entire matrix in a pair of square brackets and using a space to separate the each element, and using a semicolon to separate each row.

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% Onwubolu, G. C.
% Mechatronics: Principles & Applications
% Elsevier
%
% Mechatronics: Principles & Applications Toolbox Version 1.0
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%
% Chapter 12 Modeling in the Frequency Domain
%
% Example 12.2     MATLAB's Symbolic Math Toolbox may be used to
simplify
% the solution of simultaneous equations by using  Cramer's rule. A system of
simultaneous
% equations can be represented in matrix form by Ax = B, where A is the
matrix formed
% from the coefficients of the unknowns in the simultaneous equations, x is a
vector
% containing the unknowns, and B is a vector containing the inputs. Cramer's
rule states
% that xk, the kth element of the solution vector, x, is found using xk =
det(Ak)/det(A),
% where Ak is the matrix formed by replacing the kth column of matrix A with
the input
% vector, B. In the text we refer to det(A) as "delta". In MATLAB matrices are
written with a
% space or comma separating the elements of each row. The next row is
indicated with a
% semicolon or carriage return.  The entire matrix is then enclosed in a pair of
square
% brackets. Applying the above to the solution of Example 2.10:
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% A=[(R1+L*s) -L*s;-L*s (L*s+R2+(1/(c*s)))] and  Ak=[(R1+L*s) V;-L*s 0]. The
function
% det(matrix) evaluates the determinant of the square matrix argument. Let
us now find
% the transfer function G(s) = I2(s)/V(s), asked for in Example 2.10. The
command
% simple(S), where  S is a symbolic function, is introduced in the solution.
Simple(S)
% simplifies the solution by shortening the length of S. The use of simple(I2)
shortens
% the solution by combining like powers of the Laplace variable, s.

'Example 12.2'       % Display label.
syms s R1 R2 L1 L2 V           % Construct symbolic objects for frequency
                         % variable 's', and 'R1', 'L1', 'L2', and 'V'.
%R1=360E+3; R2=200E+3;
%L1=100E+3; L2=200E+3; V=50;
A2=[(R1+L1*s+R2) V;-R2 0]       % Form Ak = A2.
A=[(R1+L1*s+R2) -R2;-R2 (R2+L2*s)]
                         % Form A.
I2=det(A2)/det(A);           % Use Cramer's rule to solve for I2(s).
I2=simplify(I2);              % Reduce complexity of I2(s).
G=I2/V;                       % Form transfer function, G(s) = I2(s)/V(s).
'G(s)'                       % Display label.
pretty(G)                     % Pretty print G(s).
%pause
```